Drag and lift forces when moving in a cohesive granular medium

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Abstract

Studies on the forces acting on a moving object immersed in a dry granular medium have shown that strong differences exists with a classical newtonian fluid. The frictional rheology of granular media strongly alters the drag and lift forces. In particular, the drag force is proportional to the pressure exerted by the column of grains above the object, whereas the lift force is related to the pressure gradient and is positive even for a symmetrical object. By means of experiments and DEM simulations, we investigate how the introduction of cohesive forces between grains modifies the drag and lift forces. Experiments are carried out for two types of cohesive granular media: wet grains and sticky polymer coated grains. The measurements reveals that the drag is weakly impacted by the cohesion, whereas the lift is strongly diminished. DEM simulations highlight the key role played by the cohesion length in this observation.

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